

IN THE CLAIMS:

Please amend claims 1, 19, 29-33, 37 and 41 to differently recite the invention, and add new dependent claims 42-45, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application.

Claim 1 (Currently Amended): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region caused by ~~multi-photon~~ photon absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut.

Claim 2 (Original): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate under a condition with a peak power density of at least 1×10^8 (W/cm²) at the light-converging point and a pulse width of 1 μ s or less, so as to form a modified region including a molten processed region within the semiconductor substrate, and causing the

modified region including the molten processed region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut.

Claim 3 (Original): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut.

Claim 4 (Original): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut.

Claim 5 (Previously Presented): A method of cutting a semiconductor substrate according to claim 3, wherein the modified region is a molten processed region.

Claim 6 (Previously Presented): A method of cutting a semiconductor substrate according to claim 4, wherein the modified region is a molten processed region.

Claim 7 (Previously Presented): A method of cutting a semiconductor substrate according to claim 1, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 8 (Previously Presented): A method of cutting a semiconductor substrate according to claim 2, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 9 (Previously Presented): A method of cutting a semiconductor substrate according to claim 3, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 10 (Previously Presented): A method of cutting a semiconductor substrate according to claim 4, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 11 (Previously Presented): A method of cutting a semiconductor substrate according to claim 1, wherein a fracture is caused to reach a rear face of the semiconductor substrate on the side opposite from the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 12 (Previously Presented): A method of cutting a semiconductor substrate according to claim 2, wherein a fracture is caused to reach a rear face of the semiconductor substrate on the side opposite from the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 13 (Previously Presented): A method of cutting a semiconductor substrate according to claim 3, wherein a fracture is caused to reach a rear face of the semiconductor substrate on the side opposite from the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 14 (Previously Presented): A method of cutting a semiconductor substrate according to claim 4, wherein a fracture is caused to reach a rear face of the semiconductor

substrate on the side opposite from the laser light entrance side from the part which is intended to be cut acting as a start point.

Claim 15 (Previously Presented): A method of cutting a semiconductor substrate according to claim 1, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side and a rear face on the side opposite therefrom from the part which is intended to be cut acting as a start point.

Claim 16 (Previously Presented): A method of cutting a semiconductor substrate according to claim 2, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side and a rear face on the side opposite therefrom from the part which is intended to be cut acting as a start point.

Claim 17 (Previously Presented): A method of cutting a semiconductor substrate according to claim 3, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side and a rear face on the side opposite therefrom from the part which is intended to be cut acting as a start point.

Claim 18 (Previously Presented): A method of cutting a semiconductor substrate according to claim 4, wherein a fracture is caused to reach a front face of the semiconductor substrate on the laser light entrance side and a rear face on the opposite therefrom from the part which is intended to be cut acting as a start point.

Claim 19 (Currently Amended): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region caused by ~~multiphoton~~ photon absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate.

Claim 20 (Previously Presented): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate under a condition with a peak power density of at least 1×10^8 (W/cm²) at the light-converging point and a pulse width of 1 μ s or less, so as to form a modified region caused by multiphoton absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate.

Claim 21 (Previously Presented): A method of cutting a semiconductor substrate, the method comprising the steps of:

irradiating a semiconductor substrate having a sheet bonded thereto by way of a die-bonding resin layer with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate.

Claim 22 (Previously Presented): A method of cutting a semiconductor substrate according to claim 21, wherein the modified region is a molten processed region.

Claim 23 (Previously Presented): A method of cutting a semiconductor substrate having a front face formed with a functional device along a line to cut, the method comprising the steps of:

irradiating the semiconductor substrate with laser light while using a rear face of the semiconductor substrate as a laser light entrance surface and locating a light-converging point within the semiconductor substrate, so as to form a modified region, and causing the modified region to form a cutting start region within the semiconductor substrate inside of the laser light entrance surface by a predetermined distance along the line to cut;

attaching an expandable holding member to the rear face of the semiconductor substrate by way of a die-bonding resin layer after forming the cutting start region; and

expanding the holding member after attaching the holding member, so as to cut the semiconductor substrate and die-bonding resin layer along the line to cut.

Claim 24 (Previously Presented): A method of cutting a semiconductor substrate according to claim 23, further comprising the step of grinding the rear face of the semiconductor substrate such that the semiconductor substrate attains a predetermined thickness before forming the cutting start region.

Claim 25 (Previously Presented): A method of cutting a semiconductor substrate according to claim 23, wherein the modified region includes a molten processed region.

Claim 26 (Previously Presented): A method of cutting a semiconductor substrate according to claim 23, wherein a fracture is caused to reach the front face of the semiconductor

substrate from the cutting start region acting as a start point when forming the cutting start region.

Claim 27 (Previously Presented): A method of cutting a semiconductor substrate according to claim 23, wherein a fracture is caused to reach the rear face of the semiconductor substrate from the cutting start region acting as a start point when forming the cutting start region.

Claim 28 (Previously Presented): A method of cutting a semiconductor substrate according to claim 23, wherein a fracture is caused to reach the front and rear faces of the semiconductor substrate from the cutting start region acting as a start point when forming the cutting start region.

Claim 29 (Currently Amended): A method of cutting a semiconductor substrate according to claim 23, wherein the modified region includes at least a molten processed region ~~and a minute void~~ positioned on the opposite side of the molten processed region from the laser light incident face.

Claim 30 (Currently Amended): A method of cutting a semiconductor substrate according to claim 24, wherein the modified region includes at least a molten processed region ~~and a minute void~~ positioned on the opposite side of the molten processed region from the laser light incident face.

Claim 31 (Currently Amended): A method of cutting a semiconductor substrate according to claim 25, wherein the modified region includes at least a molten processed region ~~and a minute void~~ positioned on the opposite side of the molten processed region from the laser light incident face.

Claim 32 (Currently Amended): A method of cutting a semiconductor substrate having a front face formed with a plurality of functional devices to divide into every said functional devices, the method comprising the steps of:

attaching a sheet to the rear face of the semiconductor substrate by way of a die-bonding resin layer;

after the attachment of the sheet to the rear face of the semiconductor substrate, forming modified regions within the substrate in matrix so that the modified regions ~~[[run]]~~ are located just under spaces between the functional devices adjacent to each other by irradiating the semiconductor substrate with laser light while using a ~~[[rear]]~~ front face of the semiconductor substrate as a laser light entrance surface and locating a light-covering point within the semiconductor substrate, to divide the semiconductor substrate into semiconductor chips, each having the functional device thereon;

after division of the semiconductor substrate, cutting the die-bonding resin layer along a cutting surface of the semiconductor chip by expanding the sheet; and

after cutting of the die-bonding resin layer, picking up the semiconductor chip from the sheet while the picked up semiconductor chip has the die-bonding resin layer on a rear surface of the picked up semiconductor chip.

Claim 33 (Currently Amended): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region caused by ~~multi-photon~~ photon absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 34 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate under a condition with a peak power density of at least 1×10^8 (W/cm²) at the light-converging point and a pulse width of 1 μ s or less, so as to form a modified region including a molten processed region within the semiconductor substrate, and causing the modified region including the molten processed region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 35 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate and die-bonding resin layer along the part which is intended to be cut, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 36 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region within the

semiconductor substrate, and causing the modified region to form a part which is intended to be cut; and

expanding the sheet after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 37 (Currently Amended): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor device, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate, so as to form a modified region caused by ~~multi-photon~~ photon absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 38 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate under a condition with a peak power density of at least 1×10^8 (W/cm²) at the light-converging point and a pulse width of 1 μ s or less, so as to form a modified region caused by multiphoton absorption within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 39 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate, the manufacturing method comprising:

irradiating a semiconductor substrate, having a sheet bonded thereto by way of a die-bonding resin layer and having a surface formed with at least one semiconductor device, with laser light while locating a light-converging point within the semiconductor substrate, so as to

form a modified region within the semiconductor substrate, and causing the modified region to form a part which is intended to be cut;

generating a stress in the semiconductor substrate along the part which is intended to be cut after the step of forming the part which is intended to be cut, so as to cut the semiconductor substrate along the part which is intended to be cut; and

expanding the sheet after the step of cutting the semiconductor substrate, so as to cut the die-bonding resin layer along a cut section of the semiconductor substrate, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 40 (Previously Presented): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate having a front face formed with a functional device along a line to cut, the manufacturing method comprising:

irradiating the semiconductor substrate with laser light while using a rear face of the semiconductor substrate as a laser light entrance surface and locating a light-converging point within the semiconductor substrate, so as to form a modified region, and causing the modified region to form a cutting start region within the semiconductor substrate inside of the laser light entrance surface by a predetermined distance along the line to cut;

attaching an expandable holding member to the rear face of the semiconductor substrate by way of a die-bonding resin layer after forming the cutting start region; and

expanding the holding member after attaching the holding member, so as to cut the semiconductor substrate and die-bonding resin layer along the line to cut, with such cutting thereby providing at least one manufactured semiconductor device.

Claim 41 (Currently Amended): A method of manufacturing a semiconductor device formed using a method of cutting a semiconductor substrate having a front face formed with a plurality of functional devices to divide into each of said functional devices, the manufacturing method comprising:

attaching a sheet to the rear face of the semiconductor substrate by way of a die-bonding resin layer;

after the attachment of the sheet to the rear face of the semiconductor substrate, forming modified regions within the substrate in matrix so that the modified regions ~~[[run]]~~ are located just under spaces between the functional devices adjacent to each other by irradiating the semiconductor substrate with laser light while using a ~~[[rear]]~~ front face of the semiconductor substrate as a laser light entrance surface and locating a light-converging point within the semiconductor substrate, to divide the semiconductor substrate into semiconductor chips, each having the functional device thereon;

after division of the semiconductor substrate, cutting the die-bonding resin layer along a cutting surface of the semiconductor chip by expanding the sheet; and

after cutting of the die-bonding resin layer, picking up the semiconductor chip from the sheet while the picked up semiconductor chip has the die-bonding resin layer on a rear surface of the picked up semiconductor chip, such picked up semiconductor chip comprising a manufactured semiconductor device.

Claim 42 (New): A method of cutting a semiconductor substrate according to claim 1, wherein the irradiating step is performed so as to form the modified region by multiphoton absorption within the semiconductor substrate.

Claim 43 (New): A method of cutting a semiconductor substrate according to claim 19, wherein the irradiating step is performed so as to form the modified region by multiphoton absorption within the semiconductor substrate.

Claim 44 (New): A method of manufacturing a semiconductor device according to claim 33, wherein the irradiating step is performed so as to form the modified region by multiphoton absorption within the semiconductor substrate.

Claim 45 (New): A method of manufacturing a semiconductor device according to claim 37, wherein the irradiating step is performed so as to form the modified region by multiphoton absorption within the semiconductor substrate.